

Usage of converter slag in blast-cupola

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Metallurgical slags are important primary products for building materials manufacture.

However now these material resources are used insufficiently. Every year in our country the amount of slag increases, but only 12 % of steel-smelting slags are used.

Conversion and usage of slags not only enlarge a source of raw materials of building material manufacture, but also use as raw materials.

The slags make 70-85 % of all iron and steel melting wastes. Its conversion allows to increase an economic efficiency of metal manufacture and to save fluxes.

Converter slag contains more than 80 % of useful components and it is also an important material for a metal conversion.

Nowadays, the usage of converter slag for remelting of cast iron in blast cupola is important foundry industry. A slag-making in blast cupola is an inevitable and technically indispensable process for obtaining high-quality metal. In metallurgy the different fluxes are applied for creating of a specified slag conditions. Limestone, containing 49-52 % CaO, is used as a flux for remelting of cast iron in blast cupola.

We have conducted commercial researches concerning the usage of Enakievo Metallurgical Plant converter slags at Makeevka Tube-casting Plant.

There were 3 working blast cupolas at this plant. Limestone with fraction 30-90 mm and fluor-spar were used as fluxes.

Stone rate was 4-5 % of loading weight. Cast iron and pig iron, ferrosilicon, ferromanganese, ferrophosphorus, scrap have been used as charge. Foundry coke has been used as fuel.

Chemical composition of limestone was the following: 1,43 SiO₂; 2,32 Al₂O₃; 51,62 CaO; 0,63 MgO; 0,055 P; 0,01 S; 0,26 Fe.

At the time of our researches we were testing cupola slag and cast iron during usage of limestone and converter slag. The conducted researches have shown that during usage of converter slag the melting operation became hotter, the temperature of cast iron and cupola slag increased and it became more free-running.

In the metallurgy the heat balance of the process becomes better in a case of replacement limestone by converter slag.

The results of calculated heat balance are the following:

- heat consumption for limestone heating up to the dissociation temperature is 1752.3 kJ;
- heat consumption for CaCO₃ dissolution is 996.8 kJ;
- heat consumption for CaO heating up to the temperature 1573 K is 142.8 kJ;
- quantity of heat evolved from 0.44 kg of CO₂ is 359.5 kJ.

The total quantity of heat consumption for 1 kg of limestone is 3251.4 kJ/kg.

The quantity of heat for converter slag heating up to the temperature 1573 K is 1928.3 kJ/kg.

This calculation shows that usage of converter slag is more profitable than usage of limestone because of less heat consumption.

The researches at Makeevka Tube-casting Plant have shown that percentage of CaO in limestone and converter slag is almost the same. However, converter slag contains useful components for fusion such as MgO, MnO, Al₂O₃, CaF₂, Fe. Therefore converter slag is a complex flux for blast cupolas.

In a case of replacement limestone by converter slag we reduce a price of production and introduce resource-saving technology. It will have a positive influence on environment and will reduce the quantity of converter slag wastes.

Heat balance of melting confirms it.

We would recommend this technology to the foundries where the blast cupolas are used.